

FOSS Introduction



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INTRODUCTION

The Full Option Science System™ has evolved from a philosophy of teaching and learning at the Lawrence Hall of Science that has guided the development of successful active-learning science curricula for more than 40 years. The FOSS Program bridges research and practice by providing tools and strategies to engage students and teachers in enduring experiences that lead to deeper understanding of the natural and designed worlds.

Science is a creative and analytic enterprise, made active by our human capacity to think. Scientific knowledge advances when scientists observe objects and events, think about how they relate to what is known, test their ideas in logical ways, and generate explanations that integrate the new information into understanding of the natural world. Engineers apply that understanding to solve real-world problems. Thus, the scientific enterprise is both what we know (content knowledge) and how we come to know it (practices). Science is a discovery activity, a process for producing new knowledge.

The best way for students to appreciate the scientific enterprise, learn important scientific and engineering concepts, and develop the ability to think well is to actively participate in scientific practices through their own investigations and analyses. FOSS was created to engage students and teachers with meaningful experiences in the natural and designed worlds.



GOALS OF THE FOSS PROGRAM

FOSS has set out to achieve three important goals: scientific literacy, instructional efficiency, and systemic reform.

Scientific Literacy

FOSS provides all students with science experiences that are appropriate to students' cognitive development and prior experiences. It provides a foundation for more advanced understanding of core science ideas which are organized in thoughtfully designed learning progressions and prepares students for life in an increasingly complex scientific and technological world.

The National Research Council (NRC) in *A Framework for K–12 Science Education* and the American Association for the Advancement of Science (AAAS) in *Benchmarks for Scientific Literacy*, have described the characteristics of scientific literacy:

- Familiarity with the natural world, its diversity, and its interdependence.
- Understanding the disciplinary core ideas and the crosscutting concepts of science, such as patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter—flows, cycles, and conservation; structure and function; and stability and change.
- Knowing that science and engineering, technology, and mathematics are interdependent human enterprises and, as such, have implied strengths and limitations.
- Ability to reason scientifically.
- Using scientific knowledge and scientific and engineering practices for personal and social purposes.

The FOSS Program design is based on learning progressions that provide students with opportunities to investigate core ideas in science in increasingly complex ways over time. FOSS starts with the intuitive ideas that primary students bring with them and provides experiences that allow students to develop more sophisticated understanding as they grow through the grades. Cognitive research tells us that learning involves individuals in actively constructing schemata to organize new information and to relate and incorporate the new understanding into established knowledge. What sets experts apart from novices is that experts in a discipline have extensive knowledge that is effectively organized into structured schemata to promote thinking. Novices



have disconnected ideas about a topic that are difficult to retrieve and use. Through internal processes to establish schemata and through social processes of interacting with peers and adults, students construct understanding of the natural world and their relationship to it. The target goal for FOSS students is to know and use scientific explanations of the natural world and the designed world; to understand the nature and development of scientific knowledge and technological capabilities; and to participate productively in scientific and engineering practices.

Instructional Efficiency

FOSS provides all teachers with a complete, cohesive, flexible, easy-to-use science program that reflects current research on teaching and learning, including student discourse, argumentation, writing to learn, and reflective thinking, as well as teacher use of formative assessment to guide instruction. The FOSS Program uses effective instructional methodologies, including active learning, scientific practices, focus questions to guide inquiry, working in collaborative groups, multisensory strategies, integration of literacy, appropriate use of digital technologies, and making connections to students' lives, including the outdoors.

FOSS is designed to make active learning in science engaging for teachers as well as for students. It includes these supports for teachers:

- Complete equipment kits with durable, well-designed materials for all students.
- Detailed *Investigations Guide* with science background for the teacher and focus questions to guide instructional practice and student thinking.
- Multiple strategies for formative assessment at all grade levels.
- Benchmark assessments (grades 1–6) with online access for administering, coding, and analyzing assessments (grades 3–6).
- Strategies for use of science notebooks for novice and experienced users.
- *FOSS Science Resources*, a book of module-specific readings with strategies for science-centered language development.
- The FOSS website with interactive multimedia activities for use in school or at home, suggested interdisciplinary-extension activities, and extensive online support for teachers, including teacher prep videos.



Systemic Reform

FOSS provides schools and school systems with a program that addresses the community science-achievement standards. The FOSS Program prepares students by helping them acquire the knowledge and thinking capacity appropriate for world citizens.

The FOSS Program design makes it appropriate for reform efforts on all scales. It reflects the core ideas to be incorporated into the next-generation science standards. It meets with the approval of science and technology companies working in collaboration with school systems, and it has demonstrated its effectiveness with diverse student and teacher populations in major urban reform efforts. The use of science notebooks and formative-assessment strategies in FOSS redefines the role of science in a school—the way that teachers engage in science teaching with one another as professionals and with students as learners, and the way that students engage in science learning with the teacher and with one another. FOSS takes students and teachers beyond the classroom walls to establish larger communities of learners.



BRIDGING RESEARCH INTO PRACTICE

The FOSS Program is built on the assumptions that understanding core scientific knowledge and how science functions is essential for citizenship, that all teachers can teach science, and that all students can learn science. The guiding principles of the FOSS design, described below, are derived from research and confirmed through FOSS developers' extensive experience with teachers and students in typical American classrooms.

Understanding of science develops over time. FOSS has elaborated learning progressions for core ideas in science for kindergarten through grade 6. Developing the learning progressions involves identifying successively more sophisticated ways of thinking about core ideas over multiple years. "If mastery of a core idea in a science discipline is the ultimate educational destination, then well-designed learning progressions provide a map of the routes that can be taken to reach that destination" (National Research Council, *A Framework for K–12 Science Education*, 2011).

Focusing on a limited number of topics in science avoids shallow coverage and provides more time to explore core science ideas in depth. Research emphasizes that fewer topics experienced in greater depth produces much better learning than many topics briefly visited. FOSS affirms this research. FOSS modules provide long-term engagement (9–10 weeks) with important science ideas. Furthermore, modules build upon one another within and across each strand, progressively moving students toward the grand ideas of science. The core ideas of science are difficult and complex, never learned in one lesson or in one class year.

FOSS Elementary Module Sequences

PHYSICAL SCIENCE		EARTH SCIENCE		LIFE SCIENCE	
MATTER	ENERGY AND CHANGE	DYNAMIC ATMOSPHERE	ROCKS AND LANDFORMS	STRUCTURE/FUNCTION	COMPLEX SYSTEMS
6	Mixtures and Solutions	Motion, Force, and Models	Weather on Earth	Sun, Moon, and Planets	Living Systems
	Measuring Matter	Energy and Electromagnetism	Water	Soils, Rocks, and Landforms	Structures of Life
	Solids and Liquids	Balance and Motion	Air and Weather	Pebbles, Sand, and Silt	Plants and Animals
K	Materials in Our World		Trees and Weather		Insects and Plants
				Animals Two by Two	



Science is more than a body of knowledge. How well you think is often more important than how much you know. In addition to the science content framework, every FOSS module provides opportunities for students to engage in and understand scientific practices, and many modules explore issues related to engineering practices and the use of natural resources. FOSS promotes these scientific and engineering practices described in *A Framework for K–12 Science Education*.

- Asking questions (for science) and defining problems (for engineering)
- Planning and carrying out investigations
- Analyzing and interpreting data
- Developing and using models
- Using mathematics, information and computer technology, and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

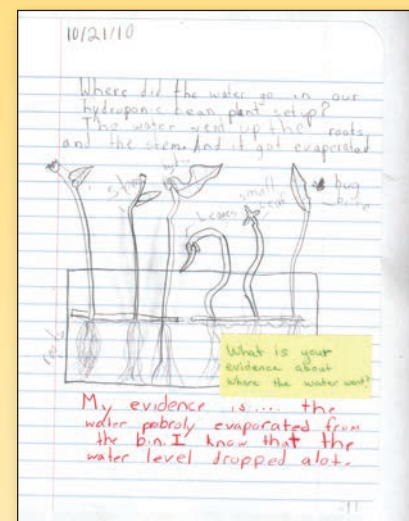
Science is inherently interesting, and children are natural investigators. It is widely accepted that children learn science concepts best by doing science. Doing science means hands-on experiences with objects, organisms, and systems. Hands-on activities are motivating for students, and they stimulate inquiry and curiosity. For these reasons, FOSS is committed to providing the best possible materials and the most effective procedures for deeply engaging students with scientific concepts. FOSS students at all grade levels investigate, experiment, gather data, organize results, and draw conclusions based on their own actions. The information gathered in such activities enhances the development of scientific and engineering practices.

Education is an adventure in self-discovery. Science provides the opportunity to connect to students' interests and experiences. Prior experiences and individual learning styles are important considerations for developing understanding. Observing is often equated with seeing, but in the FOSS Program all senses are used to promote greater understanding. FOSS evolved from pioneering work done in the 1970s with students with disabilities. The legacy of that work is that FOSS investigations naturally use multisensory methods to accommodate students with physical and learning disabilities and also to maximize information gathering for all students. A number of tools, such as the FOSS syringe and balance, were originally designed to serve the needs of students with disabilities.

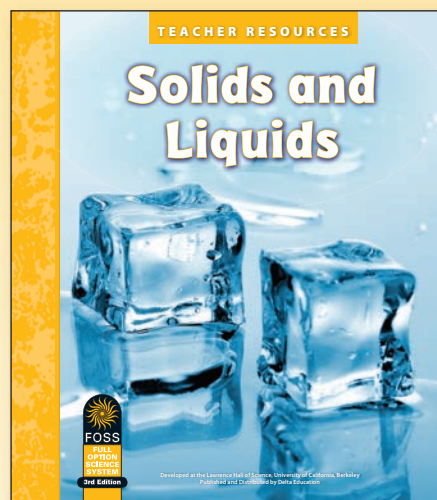
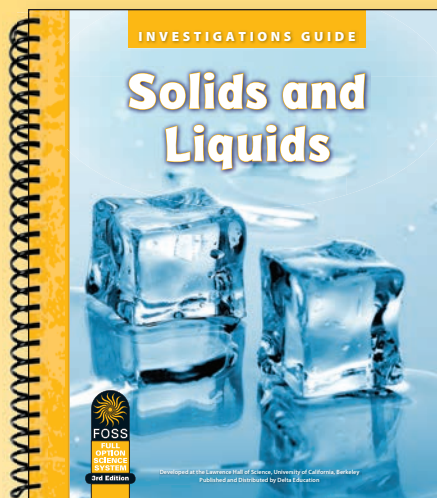
Formative assessment is a powerful tool to promote learning and can change the culture of the learning environment. Formative assessment in FOSS creates a community of reflective practice. Teachers and students make up the community and establish norms of mutual support, trust, respect, and collaboration. The goal of the community is that everyone will demonstrate progress and will learn and grow.

Science-centered language development promotes learning in all areas. Effective use of science notebooks can promote reflective thinking and contribute to life long learning. Research has shown that when language-arts experiences are embedded within the context of learning science, students improve in their ability to use their language skills. Students are eager to read to find out information, and to share their experiences both verbally and in writing.

Experiences out of the classroom develop awareness of community. By extending classroom learning into the outdoors, FOSS brings the science concepts and principles to life. In the process of validating classroom learning among the schoolyard trees and shrubs, down in the weeds on the asphalt, and in the sky overhead, students will develop a relationship with nature. It is our relationship with natural systems that allows us to care deeply for these systems.



FOSS Introduction



FOSS COMPONENTS

Teacher Toolkit

The *Teacher Toolkit* is the most important part of the FOSS Program. It is here that all the wisdom and experience contributed by hundreds of educators has been assembled. Everything we know about the content of the module and how to teach the subject is presented, along with the resources that will assist the effort. Each toolkit has three parts.

Investigations Guide. This spiral-bound document contains these chapters.

- Overview
- Materials
- Investigations
- Assessment

Teacher Resources. This collection of resources contains these chapters.

- FOSS Introduction
- Science Notebooks (for Grades K–2 or for Grades 3–6)
- Science-Centered Language Development
- Taking FOSS Outdoors
- FOSSweb and Technology
- Science Notebook Masters (for grades 1–6)
- Teacher Masters
- Assessment Masters

The chapters in *Teacher Resources* and the Spanish duplication masters can also be found on FOSSweb (www.FOSSweb.com) and are available on CDs.

FOSS Science Resources book. This is a copy of the student book of readings that are integrated into the instruction.

Equipment Kit

The FOSS Program provides the materials needed for the investigations, including metric measuring tools, in sturdy, front-opening drawer-and-sleeve cabinets. Inside, you will find high-quality materials packaged for a class of 32 students. Consumable materials are supplied for two uses.

FOSS Science Resources Books

FOSS Science Resources is a book of original readings developed to accompany each module. The readings are referred to as articles in the *Investigations Guide*. Students read the articles in the book as they progress through the module. The articles cover a specific concept usually after that concept has been introduced in an active investigation. The articles in *FOSS Science Resources* and the discussion questions provided in the *Investigations Guide* help students make connections to the science concepts introduced and explored during the active investigations. Concept development is most effective when students are allowed to experience organisms, objects, and phenomena firsthand before engaging the concepts in text. The text and illustrations help make connections between what students experience concretely and the ideas that explain their observations.

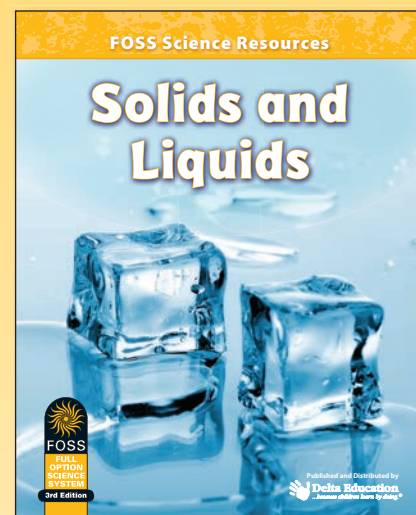
FOSSweb and Technology

The FOSS website opens new horizons for educators, students, and families, in the classroom or at home. Each module has an interactive site where students and families can find instructional activities, interactive simulations and virtual investigations, and other additional resources. FOSSweb provides resources for professional development, materials management, general teaching tools for FOSS, purchasing links, contact information for the FOSS Program and technical support. You do not need an account to view this general FOSS Program information. In addition to the general information, FOSSweb provides digital access to PDF versions of the *Teacher Resources* component of the *Teacher Toolkit* and digital-only resources that supplement the print and kit materials.

With a FOSSweb educator account, you can set up a customized homepage, which will provide easy access to the digital components of the modules you teach, and allow you to create class pages for your students with access to tutorials and online assessments.

Ongoing Professional Development

The Lawrence Hall of Science and Delta Education are committed to supporting science educators with unrivaled teacher support, high-quality implementation, and continuous staff-development opportunities and resources. FOSS has a strong network of consultants who have rich and experienced backgrounds in diverse educational settings using FOSS. Find out about professional-development opportunities on FOSSweb.



FOSS INSTRUCTIONAL DESIGN

Each FOSS investigation is designed to provide multiple exposures to science concepts. The design includes these pedagogies.

- Active investigation, including outdoor experiences
- Recording in science notebooks to answer the focus question
- Reading in *FOSS Science Resources*
- Assessment to monitor progress and motivate student reflection on learning

In practice, these components are seamlessly integrated into a continuum designed to maximize every student's opportunity to learn. An instructional sequence may move from one pedagogy to another and back again to ensure adequate coverage of a concept.

Investigation Organization

Modules are subdivided into **investigations** (four in most modules). Investigations are further subdivided into three to five **parts**. Each part of each investigation is driven by a **focus question**. The focus question, usually presented as the part begins, signals the challenge to be met, mystery to be solved, or principle to be uncovered. The focus question guides students' actions and thinking and makes the learning goal of each part explicit for teachers. Each part concludes with students recording an answer to the focus question in their notebooks. Investigation-specific **scientific background** information for the teacher is presented in each investigation chapter. The content discussion is divided into sections, each of which relates directly to one of the focus questions. This section ends with information about teaching and learning and a conceptual-flow diagram for the content.

The **Getting Ready** and **Guiding the Investigation** sections have several features that are flagged or presented in the sidebars. These include several icons to remind you when a particular pedagogical method is suggested, as well as concise bits of information in several categories.

Teaching notes appear in blue boxes in the sidebars. These notes comprise a second voice in the curriculum—an educative element. The first (traditional) voice is the message you deliver to students. It supports your work teaching students at all levels, from management to inquiry. The second educative voice, shared as a teaching note, is designed to help you understand the science content and pedagogical rationale at work behind the instructional scene.

FOCUS QUESTION

What materials stick to magnets?

TEACHING NOTE

This focus question can be answered with a simple yes or no, but the question has power when students support their answers with evidence. Their answers should take the form Yes, because . . .

The **safety** icon reminds you of a potential safety issue. It could relate to the use of a chemical substance, such as salt, requiring safety goggles, or the possibility of an allergic reaction when an investigation might expose students to latex, legumes, or wheat.

The small-group **discussion** icon asks you to pause while students discuss data or construct explanations in their groups. Often a Reporter shares the group's conclusions with the class.

The **new-word** icon alerts you to a new vocabulary word or phrase that should be introduced thoughtfully. The new vocabulary should also be entered onto the word wall (or pocket chart). A complete list of the scientific vocabulary used in each investigation appears in the sidebar on the last page of the Background for the Teacher section.

The **vocabulary** icon indicates when students should review recently introduced vocabulary, often just before they will be answering the focus question or preparing for benchmark assessment.

The **recording** icon points out when students should make a science-notebook entry. Students record on prepared notebook sheets or, increasingly, on blank pages in their science notebooks.

The **reading** icon signals when the class should read a specific article in *FOSS Science Resources*, preferably during a reading period.

The **assessment** icon appears when there is an opportunity to assess student progress by using embedded or benchmark assessments. Some of the embedded-assessment methods include observation of students engaged in scientific practices and review of a notebook entry.

The **outdoor** icon signals when to move the science learning experience into the schoolyard. It also helps you plan for selecting and preparing an outdoor site for a student activity.

The **engineering** icon indicates opportunities for addressing engineering practices—applying and using scientific knowledge. These opportunities include developing a solution to a problem, constructing and evaluating models, and using systems thinking.

The **EL Note** in the sidebar provides a specific strategy to assist English learners in developing science concepts. A more fully elaborated discussion of strategies is provided in the Science-Centered Language Development chapter.

To help with pacing, you will see the icon for **breakpoints**. Some breakpoints are essential, and others are optional.



EL NOTE

See the Science-Centered Language Development chapter for notebook-sharing strategies.

POSSIBLE BREAKPOINT



Active Investigation

- *Context*
- *Activity*
- *Data management*
- *Analysis*

Active Investigation

Active investigation is a master pedagogy. Embedded within active learning are a number of pedagogical elements and practices that keep active investigation vigorous and productive.

Context: questioning and planning. Active investigation requires focus.

The context of an inquiry can be established with a focus question or challenge from you or, in some cases, from students. At other times, students are asked to plan a method for investigation. This might start with a teacher demonstration or presentation. Then you challenge students to plan an investigation. In either case, the field available for thought and interaction is constrained. This clarification of context and purpose results in a more productive investigation.

Activity: doing and observing. In the practice of science, scientists put things together and take things apart, observe systems and interactions, and conduct experiments. This is the core of science—active, firsthand experience with objects, organisms, materials, and systems in the natural and designed worlds. In FOSS, students engage in the same processes. Students often conduct investigations in collaborative groups of four, with each student taking a role to contribute to the effort.

The active investigations in FOSS are cohesive and build on each other and the readings to lead students to a comprehensive understanding of concepts. Through the investigations, students gather meaningful data.

Data management: recording and organizing. Data accrue from observation, both direct (through the senses) and indirect (mediated by instrumentation). Data are the raw material from which scientific knowledge and meaning are synthesized. During and after work with materials, students record data in their notebooks. Data recording is the first of several kinds of student writing.

Students then organize data so that the data will be easier to think about. Tables allow efficient comparison. Organizing data in a sequence (time) or series (physical property) can reveal patterns. Students process some data into graphs, providing visual display of numerical data. Students also organize data and process them in the science notebook.

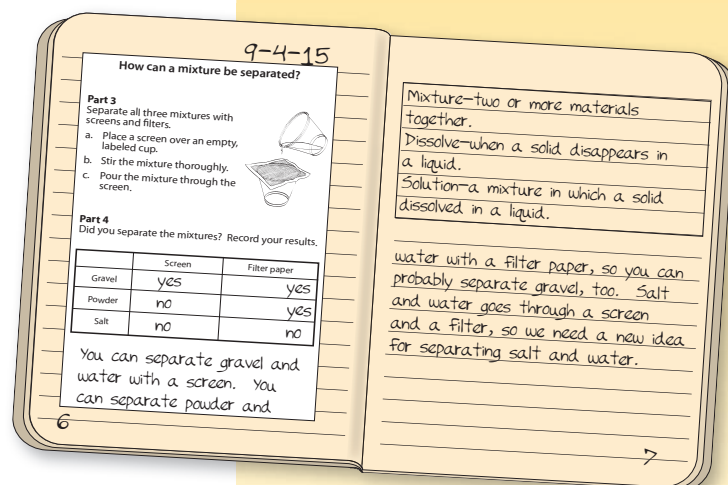


Analysis: discussing and writing explanations. The most important part of an active investigation is extracting its meaning. This constructive process involves logic, discourse, and existing knowledge. Students share their explanations for phenomena, using evidence generated during the investigation to support their ideas. They conclude the active investigation by writing a summary of their learning in their science notebooks as well as questions raised during the activity.

Science Notebooks

Research and best practice have led FOSS to place more emphasis on the student science notebook. Keeping a notebook helps students organize their observations and data, process their data, and maintain a record of their learning for future reference. The process of writing about their science experiences and communicating their thinking is a powerful learning device for students. The science-notebook entries stand as a credible and useful expression of learning. The artifacts in the notebooks form one of the core elements of the assessment system.

You will find the duplication masters for grades 1–6 presented in notebook format. They are reduced in size (two copies to a standard sheet) for placement (glue or tape) into a bound composition book. Full-size duplication masters are also available on FOSSweb. Student work is entered partly in spaces provided on the notebook sheets and partly on adjacent blank sheets.



Reading in FOSS Science Resources

FOSS Science Resources emphasizes expository articles and biographical sketches. FOSS suggests that the reading be completed during language-arts time. When language-arts skills and methods are embedded in content material that relates to the authentic experience students have had during the FOSS active-learning sessions, students are interested, and they get more meaning from the text material.





Assessing Progress

The FOSS assessment system includes both formative and summative assessments. Formative assessments monitor learning during the process of instruction. They measure progress, provide information about learning, and are generally diagnostic. Summative assessment looks at the learning after instruction is completed, and it measures achievement.

Formative assessment in FOSS, called **embedded assessment**, occurs on a daily basis. You observe action during class or review notebooks after class. Embedded assessment provides continuous monitoring of students' learning and helps you make decisions about whether to review, extend, or move on to the next idea to be covered. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and you look at their notebook entries. Embedded assessment is assessment *for* learning, not assessment *of* learning.

Benchmark assessments are short summative assessments given at the end of each investigation. These I-Checks are actually hybrid tools: they provide summative information about students' achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. The assessment items do not simply identify whether a student knows a piece of science content. The items identify the depth to which students understand science concepts and principles and the extent to which students can apply that understanding. Since the output from the benchmark assessments is descriptive and complex, it can be used for formative as well as summative purposes.

Taking FOSS Outdoors

FOSS throws open the classroom door and proclaims the entire school campus to be the science classroom. The true value of science knowledge is its usefulness in the real world and not just in the classroom. Taking regular excursions into the immediate outdoor environment has many benefits. First of all, it provides opportunities for students to apply things they learned in the classroom to novel situations. When students are able to transfer knowledge of scientific principles to natural systems, they experience a sense of accomplishment.

In addition to transfer and application, students can learn things outdoors that they are not able to learn indoors. The most important object of inquiry outdoors is the outdoors itself. To today's youth, the outdoors is something to pass through as quickly as possible to get to the next human-managed place. For many, engagement with the outdoors and natural systems must be intentional, at least at first. With repeated visits to familiar outdoor learning environments, students may first develop comfort in the outdoors, and then a desire to embrace and understand natural systems.

The last part of most investigations is an outdoor experience. Venturing out will require courage the first time or two you mount an outdoor expedition. It will confuse students as they struggle to find the right behavior that is a compromise between classroom rigor and diligence and the freedom of recreation. With persistence, you will reap rewards—you might be amazed by the transformation of students with behavior issues in the classroom who become your insightful observers and leaders in the schoolyard environment.





Science-Centered Language Development

The FOSS active investigations, science notebooks, *FOSS Science Resources* articles, and formative assessments provide rich contexts in which students develop and exercise thinking and communication. These elements are essential for effective instruction in both science and language arts—students experience the natural world in real and authentic ways and use language to inquire, process information, and communicate their thinking about scientific phenomena. FOSS refers to this development of language process and skills within the context of science as science-centered language development.

There are many ways to integrate language into science investigations. The most effective integration depends on the type of investigation, the experience of students, the language skills and needs of students, and the language objectives that you deem important at the time. The Science-Centered Language Development chapter is a library of resources and strategies for you to use. The chapter describes how literacy strategies are integrated purposefully into the FOSS investigations, gives suggestions for additional literacy strategies that both enhance students' learning in science and develop or exercise English-language literacy skills, and develops science vocabulary with scaffolding strategies for supporting all learners.

FOSSweb and Technology

FOSS is committed to providing a rich, accessible technology experience for all FOSS users. FOSSweb is the Internet access to FOSS digital resources. It provides enrichment for students and support for teachers, administrators, and families who are actively involved in implementing and enjoying FOSS materials.

Technology to Engage Students at School and at Home

Multimedia activities. These include virtual investigations and student tutorials to support students who have difficulties or who have been absent.

FOSS Science Resources. The student reading book is available as an audio book on FOSSweb. In addition, as premium content, *FOSS Science Resources* is available as an eBook.

Home/school connection. Each module includes a letter to families that provides an overview of the goals and objectives of the module available in print on FOSSweb.

Student media library. A variety of media enhance students' learning, including photos, videos, audio versions of student books, and frequently asked science questions.

Recommended books and websites. FOSS has reviewed print books and digital resources that are appropriate for students and prepared a list of these media resources.

Class pages. Teachers with a FOSSweb account can set up class pages with notes and assignments for students and families to access online.

Technology to Support Teachers

Teacher-preparation video. The video presents information to help you prepare for a module, including detailed investigation information and equipment setup and use.

Science-notebook masters and teacher masters. All notebook masters and teacher masters used in the modules are available digitally on FOSSweb for downloading and for projection during class. These sheets are available in English and Spanish.

Assessment masters. The benchmark assessment masters for grades 1–6 (I-Checks) are available in English and Spanish.

Focus questions. The focus questions for each investigation are formatted for classroom projection and for printing onto 1" × 2½" mailing labels that students can glue into their science notebooks.



FOSS Introduction

Equipment photo cards. The cards provide labeled photos of equipment supplied in the FOSS kit.

Materials Safety Data Sheets (MSDS). These sheets have information from materials manufacturers on handling and disposal of materials.

Module summary. The summary describes each investigation in a module, including major concepts developed.

Module updates. These are important updates related to the teacher materials, student equipment, and safety guidelines.

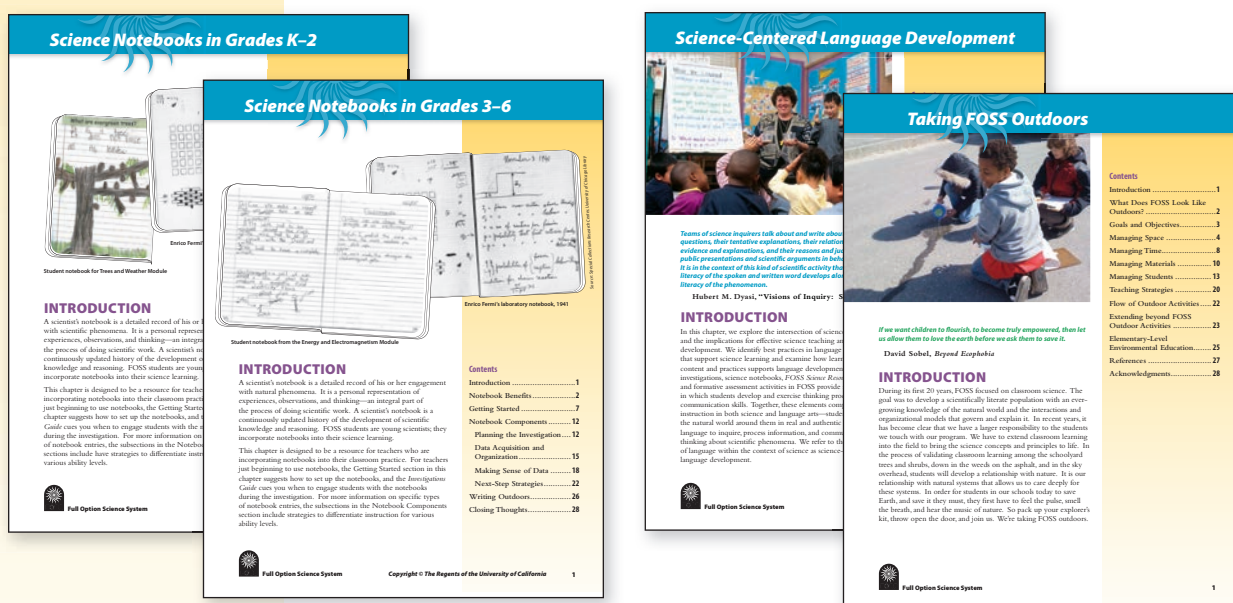
Module teaching notes. These notes include teaching suggestions and enhancements to the module, sent in by experienced FOSS users.

Streaming video. Some video clips are part of the instruction in the investigation, and others extend concepts presented in a module.

Resources by investigation. This digital listing provides online links to notebook sheets, assessment and teacher masters, and multimedia for each investigation of a module, for projection in the classroom.

Interactive whiteboard resources. You can use these slide shows and other resources with an interactive whiteboard.

Teacher Resources chapters. FOSSweb provides PDF files of these chapters in *Teacher Resources*—Science Notebooks, Science-Centered Language Development, Taking FOSS Outdoors, and FOSSweb and Technology.



Investigations eGuide. The eGuide is the complete *FOSS Investigations Guide* component of the *Teacher Toolkit* in an electronic web-based format, allowing access from any Internet-enabled computer.

FOSSmap and online assessments. A computerized assessment program, called FOSSmap, provides a system for students to take assessments online, and for you to review those assessments online and to assign tutorial sessions for individual students based on assessment performance. After students have completed a benchmark assessment, FOSSmap automatically codes the multiple-choice, multiple-answer, and short-answer questions. Once the codes are in the FOSSmap program, you can generate and display several reports.

The *Code-Frequency Report* is a bar graph showing how many students received each code. This graph makes it easy to see which items might need further instruction.

In the *Class-by-Item Report*, information for each item is presented in a text format that indicates the names and percentages of students who selected each answer, what code (score) they received, and a description of what students know or need help with based on how they answered each item.

The *Class-by-Level Report* describes four levels of achievement. It lists class percentages and students who achieved each level.

The *Class-Frequency Report* has bar graphs indicating how many students achieved each level. The survey and posttest are shown on the same page for easy comparison.

The *Student-by-Item Report* is available for each student. It provides information about what the student knows or what he or she needs to work on.

The *Student Assessment Summary* bar graph indicates the level achieved by individual students on all the assessments taken up to any point in the module. This graph makes it easy to compare achievement on the survey and posttest as well as on each I-Check.

Tutorials. You can assign online tutorials to individual students, based on how each student answers questions on the I-Checks and posttest. The *Student-by-Item Report*, generated by FOSSmap, indicates the tutorials specifically targeted to help individual students to refine their understandings. Tutorials are an excellent tool for differentiating instruction and are available to students at any time on FOSSweb.

FOSS K–8 SCOPE AND SEQUENCE

Grade	Physical Science	Earth Science	Life Science
6–8	Electronics Chemical Interactions Force and Motion	Planetary Science Earth History Weather and Water	Human Brain and Senses Populations and Ecosystems Diversity of Life
4–6	Mixtures and Solutions Motion, Force, and Models Energy and Electromagnetism	Weather on Earth Sun, Moon, and Planets Soils, Rocks, and Landforms	Living Systems Environments
3	Measuring Matter	Water	Structures of Life
1–2	Balance and Motion Solids and Liquids	Air and Weather Pebbles, Sand, and Silt	Insects and Plants Plants and Animals
K	Materials in Our World	Trees and Weather	Animals Two by Two

FOSS is a research-based science curriculum for grades K–8 developed at the Lawrence Hall of Science, University of California, Berkeley. FOSS is also an ongoing research project dedicated to improving the learning and teaching of science. The FOSS project began over 25 years ago during a time of growing concern that our nation was not providing young students with an adequate science education. The FOSS Program materials are designed to meet the challenge of providing meaningful science education for all students in diverse American classrooms and to prepare them for life in the 21st century. Development of the FOSS Program was, and continues to be, guided by advances in the understanding of how people think and learn.

With the initial support of the National Science Foundation and continued support from the University of California, Berkeley, and School Specialty, Inc., the FOSS Program has evolved into a curriculum for all students and their teachers, grades K–8. The current editions of FOSS are the result of a rich collaboration between the FOSS/Lawrence Hall of Science development staff; the FOSS product development team at Delta Education; assessment specialists, educational researchers, and scientists; dedicated professionals in the classroom and their students, administrators, and families.

We acknowledge the thousands of FOSS educators who have embraced the notion that science is an active process, and we thank them for their significant contributions to the development and implementation of the FOSS Program.